ROLE PLAYING OR PLAYING WITH ROLES? A CASE STUDY OF WOMEN IN THE WORKFORCE DURING WORLD WAR II

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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The construction industry is a very complex and intricate system of players which requires the cooperation and communication of all involved parties to produce a successful end project. Employing Delay Analysis Techniques (DATs) to previous construction projects is crucial to understand the effects of delays on the overall project completion time, total budgeted cost, or both. The technical research aims to identify delays within the construction industry to create an inclusive guideline for companies to engage with in order to generate project plans and schedules with greater efficiency for future endeavors. In order to adequately understand and improve the efficiency of the construction workforce through its performance indicators seen today, a comparison to the model of the diverse workforce during World War II (WWII) will be used as the tightly coupled STS research topic. During this time period, women entered into the engineering workforce, a sector which before only allowed males. Due to this sudden influx of a new labor force, discrimination in the workplace was a major concern. Through this STS research, the similarities between women in the workforce during WWII and women in the workforce today will be evaluated to determine how discrimination within the workplace has affected their performance.

WOMEN'S ARRIVAL INTO THE WORKFORCE

In the early 1940s, with World War II in full swing, many changes occurred among the available workforce. During this time period, social climates were rapidly changing to account for high tensions. With the disappearance of available working men due to their commitment to war efforts, employers which previously discriminated against hiring women suddenly opened their doors to meet production needs. Prior to the war, most women worked in traditionally female fields like nursing and teaching, and those who did not work were the primary caretakers for their household. After Pearl Harbor, however, this dynamic greatly shifted. History.com

Editors (2010) commented that after this incident, women worked in many positions which were previously designated only for men, with the aviation industry having the greatest increase in numbers (para. 4). “More than 310,000 women worked in the U.S. aircraft industry in 1943, representing 65 percent of the industry’s total workforce (compared to just 1 percent in the pre-war years)” (History.com Editors, para. 4). Aside from the aircraft industry, other sectors of work were lacking in their availability of labor force as well. Author/editor Fowle (1992) for the US Army Corps of Engineers detailed how crucial civil engineering projects were underway, such as “maintain[ing] navigable waterways, help[ing] control floods, and provid[ing] hydropower” (p. 3). Notable write Horne (2019) stated that in 1941 an estimated six million women joined the labor force to complete jobs previously closed off to them (para. 2). Figure 1 below shows a graphical representation of the percent change of women within various job sectors over the primary years of the war.

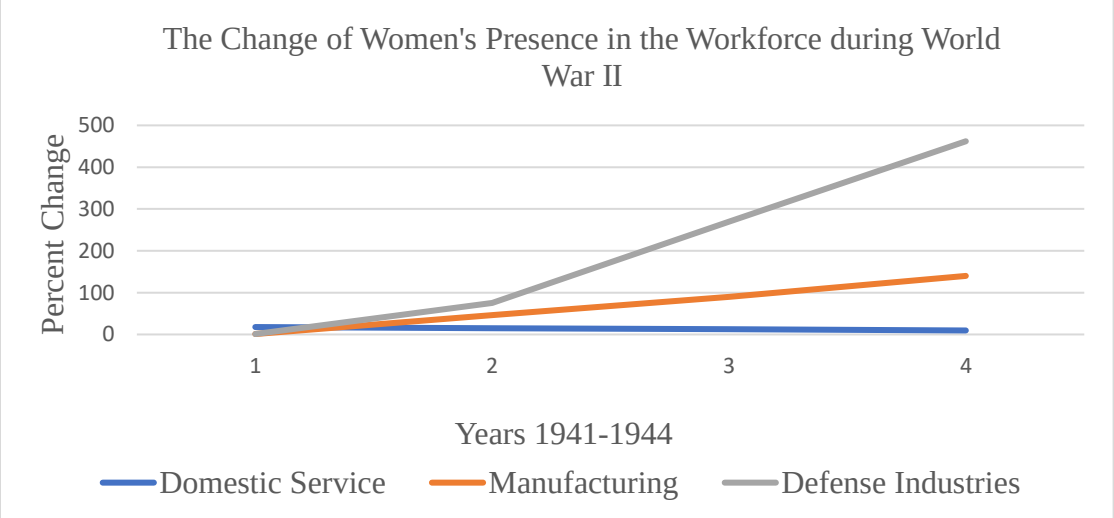

Figure 1: Women in the Workforce. This figure shows the percent change of women in the workforce in specific industries during World War II. (Created by A. Zimmerman from R. Milkman, 1982).

Figure 1 shows that by 1944, 8 million women were employed, including a 462% increase in growth of female employment in defense industries (Yesil, 2004, p. 105). By 1945, “nearly one

out of every four married women worked outside the home" (History.com Editors, 2010, para. 1). With this new position within society, women's roles were rapidly changed forever. Were these women adapting to their new positions and playing with their traditional roles, or were they simply role playing the man's position until they returned home from the war?

PERCEPTION OF WOMEN IN THE INDUSTRY DURING WWII

Women's roles in their newfound positions as *engineers* during World War II were very complex. The roles of engineers today are more widespread within the industry, executing a variety of research within multiple fields with the main goal of improving society. Engineers during the time period of WWII, however, were heavily focused in the defense sector, producing technology to aid the military such as airplanes, warplanes, ships, tanks, and armored cars. The industries were able to begin adapting to this new set of workers, allowing for a "continuous improvement in production methods and in utilization of women workers throughout the war period" (Durr, Lide, West, & Freeman, 1991, p. 32). Although women's application in the workforce was improving, there were still many relational factors they had to juggle. Some of these included relationship dynamics with their male coworkers, their female coworkers, their supervisors, their family at home, and their family in the war. In order to have a better understanding of the roles women played in WWII, and how their performances were evaluated, the Actor Network Theory (ANT) shown in Figure 2 below will be the model for this aspect of research (Callon, Latour, & Law, 1980). The ANT is a visual representation used to better understand the system between science and technology, and the actors which interact with them. Examples include entities such as the government, knowledge, readings, money, and surrounding people (Cressman, 2009, p. 3).

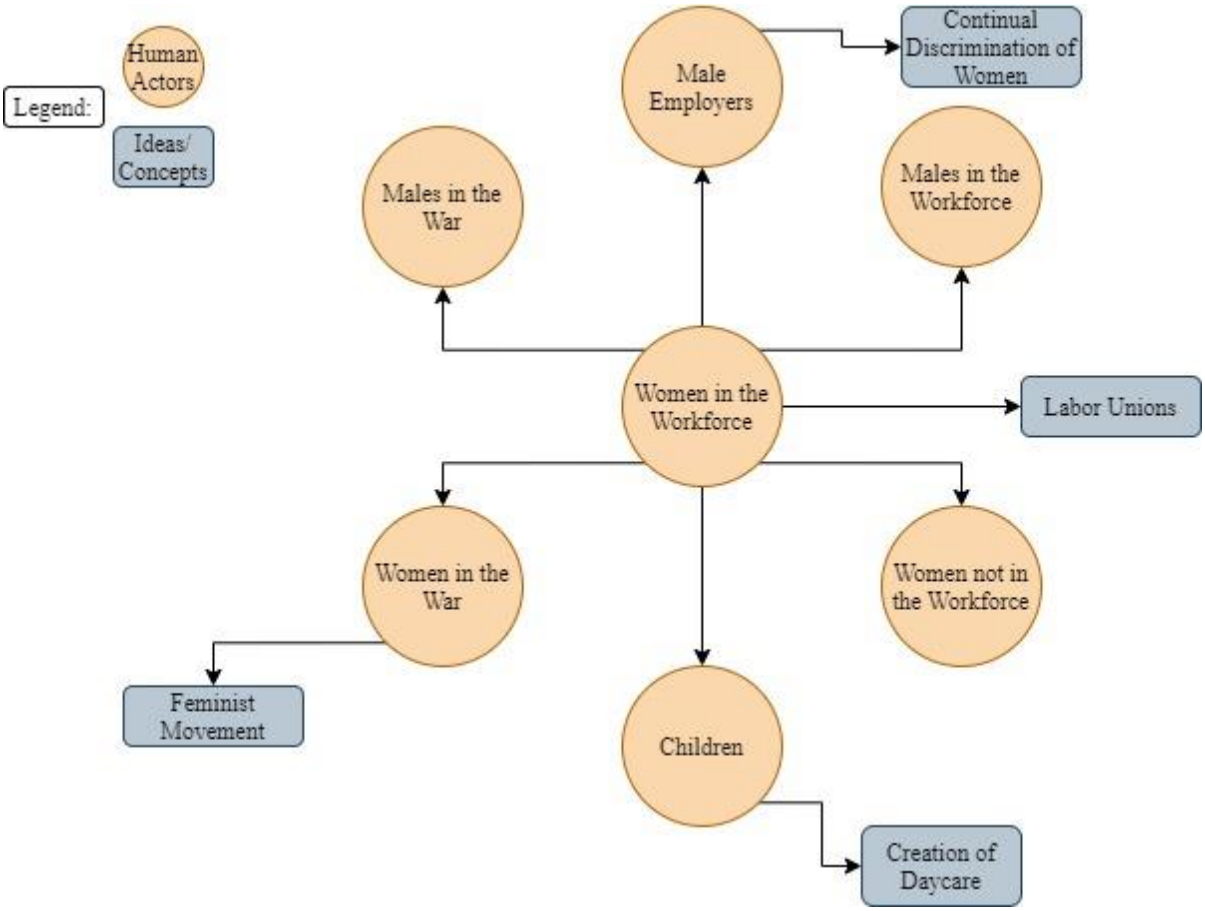

Figure 2: ANT of Women in WWII. This figure shows the different relationships present between women in the workforce during WWII with other human actors, as well as some of the concepts which were created from these relationships. (Created by A. Zimmerman, 2020).

The ANT shown in Figure 2 depicts the relationships involving women in the workforce, and how further ideas and concepts can stem from human actors.

A loaded concept that emerges from the ANT analysis is the feminist movement which was sparked as a result of World War II. A prominent addition to this movement was the Rosie the Riveter' propaganda campaign. This "strong, bandanna-clad Rosie became one of the most successful recruitment tools in American history, and the most iconic image of working women during World War II" (History.com Editors, 2010, para. 4). With the new need for women in roles traditionally unavailable to them, females had a newfangled energy. Respect and

recognition for their work began to be seen by their undeniable contributions. In some occasions, women were able to perform even better than the male previously in their position could. For example, 5' tall, 90-pound year old Helen Warren was so small that she was able to work on the wing areas of the B-17 planes she was updating (Beaton, 2020, p. 147). All in all, women were "proud of their contribution" and "showed the enemy that the women of America were a force to be reckoned with" (Beaton, 2020, p. 149).

Another important concept which stemmed from women in the workforce during World War II was childcare. Previously, mothers were expected to stay home with their children and be the primary caretakers of their family. With so many mothers being taken into work, the need for new forms of childcare developed as there was no longer anyone available to take care of the children at home. In 1940, the Lanham Act was created, which "gave war-related government grants for childcare services in communities where defense production was a major industry" (History.com Editors, 2010, para. 6). A major proponent for this support was Eleanor Roosevelt, who helped to pass the Community Facilities Act, which led to the creation of the first U.S. government-sponsored childcare center (History.com Editors, 2010, para. 6). Roosevelt also urged for reforms like "staggered working hours at factories to allow working mothers to go to grocery stores—stores that were often either closed or out of stock by the time women clocked out of work" (History.com Editors, 2010, para. 6). Although these mechanisms were in place to help women with regards to their familial dynamics, other relational dynamics existed within the workplace which proved to be equally problematic.

As shown in Figure 2 on page 4, one of the connections to women in the workforce is men in the war. During this time period, many of the industries in need of a more available workforce were in engineering, a previously male dominated field. Therefore, women were

trained to replace male engineers due to the shortage of them from the war (Beaton, 2020, p. 153). There also existed the relationship between working women and men who didn't join the frontline of WWII. These men include not only the employers, but the coworkers working alongside the females. Within these two groups, continual separation and discrimination of women existed. Former professor Geoff Chivers (1979) claimed that this separation was not out of the ordinary, and that the United States had an even stricter framework of role designation by sex than European countries (p. 29). The topic of gender discrimination was especially relevant during the early 1940s. Chivers noted that "above all else there was the attitude that engineering was a man's job, and that it was 'unnatural' for women to consider a career in engineering" (Chivers, p. 28). The many examples and sources of discrimination which the women of WWII face only added to their already challenging and strenuous work lives.

GENDER DISCRIMINATION WITHIN THE WORKFORCE

With the influx of women into typically male positioned roles during World War II, it makes natural sense to assume that these women had a hard entrance into their profession. Some individuals have believed, however, that women had purposefully chosen to not enter into these engineering focused fields. For example, former professor Geoff Chivers (1979) from Loughborough University, UK, stated that "able girls often take considerable care not to excel in [physics, maths, or other 'boys' subjects] because of the possible slur that they have boyish tendencies" (p. 29). This claim is extremely interesting, not only from the aspect of the conclusion drawn, but from the basis of the argument as a whole. In fact, this statement can be seen as discriminatory in itself. In today's society, the idea that a woman in the United States would purposefully sabotage her own intellectual intelligence on the pure basis of not being categorized as the opposite sex sounds quite outlandish. However, it is important to take into

consideration that this source was published in 1979, therefore there may have been a stronger preconceived notion of the respective roles for boys and girls, and more room to speak on the opinions behind these. This scholar's research was developed in 1979, over 30 years after the end of World War II. By comparing the general atmosphere of these different time periods, women's performance and contribution to the war efforts hold an even higher esteem. Although their general 'place' in society was already predetermined for them, they were able to surpass these confinements and proved to be invaluable assets for the American home front.

The work in which the women of World War II did in their job placements is extraordinary. Historical writer Beaton (2020) quoted there was "unanimity of opinion to the effect that the girls were outstanding" in their educational training programs (p. 155). However, there were still prepossessed notions of what these women represented in society. There are numerous anecdotal recollections of discriminatory attitudes towards these women students in the previously all-male training institutions. For example, throughout the early-mid 1900s, it was typical for male engineers to be seen with a slide rule hanging from the belt of their pants (Beaton, p. 155). Once women engineers began adapting to this norm, it was reported that "one professor broke out in laughter upon entering his classroom and being confronted with twenty-five cadettes dangling slide rules," as the adoption of this practice by women was ridiculed because of their minority status (Beaton, p. 155). The site of slide rules was typical in this sort of setting, but the simple fact that it was women carrying them caused the scene to be amusing for the professor. This basic example helps depict the unaccepting social environment which these women had to endure in their newfound careers.

Women in the 1940s were discriminated against in an educational setting not solely due to their academic abilities. In a school-like environment, and consequentially in their workplace

environment, women were hyper-sexualized. With the introduction of women into the classroom, "one professor wore a wedding ring," even though he wasn't married, "thinking he might have to fight off advances from his female students" (Beaton, 2020, p. 154). This situation really highlights the generality of opinions that men retained about women. Within the workplace, women experienced similar happenings in feeling talked down upon and treated differently due to their sex. However, graduate professor Milkman (1982) made the point that although "Rosie the Riveter did a 'man's job'," such as within the auto industry, "…more often than not she worked in a predominantly female department or job classification" (p. 338). Along this idea, many women were separated from their counterparts and segregated into their own areas of work, partly to avoid distractions and relations among workers. This sexualization of women is only one of the many discriminatory factors which affected them in their everyday lives. Another very real consequence of their unfamiliar gender within the workplace was unequal pay.

Women's entrance into the engineering and STEM fields during World War II was a big change from their predominant roles as nurses and teachers. Along with these new positions came expectedly higher pay. Relationally, women in these fields recognized their increase in salary, and women in other industries even would refer to the women in engineering as "rich". For example, Louise Fayram, an engineer during this time period in Columbus, Ohio, "could not recall her wage or overtime pay scale, only that she and her two roommates… were happy with it" (Beaton, 2020, p. 156). However, it is important to note that these women were still paid less than their equivalent male counterparts (Beaton, 2020, p. 161). Some of these women accepted the pay inequities simply because they were better off than before. Among the discrimination within women in the industry, there was even further divide within them. Although black women had better positions than working as servants in the homes of white families, or working in fields

or on small farms, they "often were paid less than white women" (Levine, 2018, para. 10). Additionally, some plants did not allow black women to work as employees at all. This topic deals with wider discrimination of black individuals during this time period, and although this is not the topic being addressed, it is still important to mention and consider.

Through statistical research in salary comparisons, or through anecdotal research, like on the perception and inclusion of women within the workforce, there was strongly apparent discrimination within the World War II time period. Women's immense contribution to the war is undeniable, and the American home front would not have survived without their inputs. However, based solely on their gender, they were not treated as equal. Their efforts were not unnoticed, though. Not only did this group of women make history with their involvement in the field of engineering during World War II, they paved the way for women that followed to pursue similar career paths. These women were some of the first concrete examples of female's competency and capability in the workforce outside of their previous roles, and are not to be forgotten.

WOMEN IN ENGINEERING TODAY

In present day, there has been an increase in social attention to the disproportion of sexes within the STEM industry. In 2019, however, Chaudhry, Wall, and Wall noted that women are still "alarmingly underrepresented", most notably in the tech industry (p. 275). Within this industry, women only make up 25% of all employees, yet represent about 51% of the entire working population (Chaudhry, Wall, & Wall, p. 275). Unfortunately, this trend is closely followed within other engineering fields as well. As a result of their minority status in the workplace, there are distinctive pressures that women face. Aside from feeling the need to "do more" or overwork themselves to prove their capabilities, Ehrhart and Sandler (1987) mention

how women may also be subject to "greater scrutiny" due to being "overly visible within their departments" (p. 7). In addition to the hardships of having a small cohort of women surrounding them in the workplace, there is greater difficulty for women to excel in their role as it is much less likely to find female faculty and other women in high positions to serve as effective role models" (Ehrhart & Sandler, p. 7). It is interesting, however, to note that the statistical data of women's performance within STEM related subjects does not mirror their participation in the industry post-education. In fact, "actual data shows that women frequently score higher in STEM courses when compared to men … [yet] exhibit disproportionately low enrollments in in engineering (24%) [degree programs]" (Chaudhry, Wall, & Wall, p. 275). Many factors can be attributed to the lack of participation of women in STEM related fields, however, discrimination is a major one to consider. Although the time period and circumstances were significantly different in the 1940s and today, women in the workforce in both eras have experienced similar forms of discrimination.

WOMEN DURING WWII COMPARED TO TODAY'S WOMEN

Upon examining the general trend of the proportion of women in the workforce, discrimination is easily recognized. Before the war began, "there were very few women professional engineers, certainly much less than one percent of the total number of professional engineers" (Chivers, 1979, p. 28). Once the war was underway, however, "women made up more than half of the nation's work force" for the first time (Levine, 2018, para. 4). Due to the intense need for a larger available workforce as a result of the sudden decrease of qualified individuals because of the war effort, targeting the women population was crucial to keep essential work functioning. However, women's places in these positions were not permanent. Notable editors for History.com (2010) commented that "with the return of male soldiers at war's end, women,

especially married women, were once again pressured to return to a life at home, a prospect that, for thousands of American women, had shifted thanks to their wartime service" (para. 1). Today, the lasting effects of women's exit from the workforce after the war are seen as only a mere 13% of engineers today are women (Rincon, 2019, para. 5). In this sense, there are dissimilarities to women in engineering during WWII and today in terms of the proportion of women present in the industry. Although the women of the early 1940s broke the barriers to allow women to continue joining into the workforce in the following years, discrimination has persisted as there has yet to be a time in history where the proportion of women in the workforce equated to the number during WWII. This may be due in part to the fact that there has not been a severe shortage of available individuals since that time period, and therefore there has not been the impending need to alter the already established labor pool. However, it is crucial to continue evaluating this situation and push for an increase of women engineers both to increase diversity of the field and to improve the industry as a whole by allowing for different perspectives to have a voice.

Salary Differences Among Genders Within the Engineering Field

When comparing women in the workforce during WWII and women in present day, one of the similarities which arises is the pay gap due to gender within the engineering field. During the time period of World War II, women's "pay continued to lag far behind their male counterparts: Female workers rarely earned more than 50 percent of male wages" (History.com Editors, 2010, para. 5). Although these females were performing the same jobs and functions as the males previously in their positions or surrounding them, they were faced with alarmingly inequitable pay rates. Analogous situations have been occurring since then, and continue to persist into today's society.

The gender pay gap has been a societal issue that has gained more spotlight in the previous decade. Outside of the engineering workforce, although progress has been made "over the last few decades, women still make 20% less than men in similar positions" (Rincon, 2018, para. 1). Within the engineering industry, however, the Manager of Research for the Society of Women Engineers, Roberta Rincon, noted that "female engineers still receive about 90 cents per dollar earned by their male counterparts" (2018, para. 3). This sad truth is one of the main reasons for the low retention rates of women in STEM industries. Figure 3 below shows some statistical findings of women who end up leaving these workplaces.

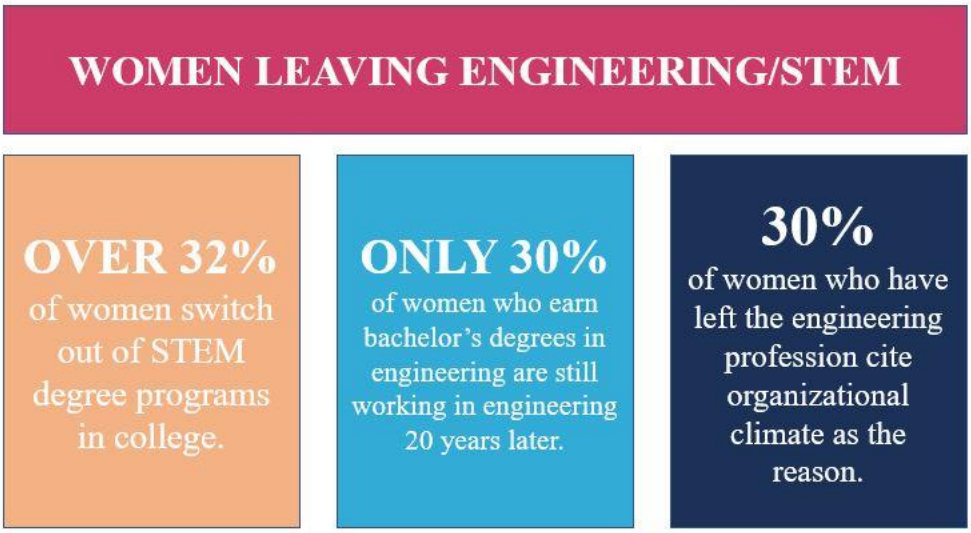

Figure 3: Today's Women in the Engineering Workforce. This figure shows the statistics of women in the engineering and STEM fields updated in 2019, and highlights their notably low retention rates within the industry. (Adapted by A. Zimmerman from R. Rincon, 2019).

As displayed, about a third of women switch out of a STEM major in college, and of those who decide to continue pursuing these degrees, less than a third continue working in the field as time goes on. Additionally, many women claim to have left these workplaces due to the "organizational climate". Chaudhry, Wall, and Wall (2019) agree with this, and state that "discrimination is the main factor that plays into women's decision-making about leaving a

company" (p. 275). More specifically, they leave "because of gender and non-supportive work environments" (Chaudhry, Wall, & Wall, p. 275). It is important to analyze the discrimination that women in both time periods have faced to determine the effect it has had on them, not only intrinsically in their work but holistically as well.

HOW DISCRIMINATION HAS AFFECTED WORKPLACE PERFORMANCE

Women were discriminated against in similar manners during World War II and present day, negatively affecting women's job performance. More obviously, discrimination has harvested a space where these individuals feel less accepted or welcomed. In turn, this limits their possibility to be more creative and take risks within the workforce which potentially could be extremely beneficial to the industry at large. Without the American women of World War II, the place for women engineers in society today would be largely lessened. These women were concrete examples of how valuable and advantageous their abilities are, and demonstrated their benefit through multiple avenues during the war. Due to their advancement for women in general in the workforce, they deserve far more recognition and appreciation than previously given. Recently, however, one form of credit has been distributed.

One group of lesser-known women during World War II were the Women's Airforce Service Pilots, or WASPs. These women were the first to fly American military aircraft, yet they were "considered civil service employees and without official military status…WASPs were granted no military honors or benefits, and it wasn't until 1977 that the WASPs received full military status. On March 10, 2010, at a ceremony in the Capitol, the WASPS received the Congressional Gold Medal, one of the highest civilian honors" (History.com Editors, 2010, para. 3). This is one example of how the women of this time period have recently started to be recognized, but there is far more that could be done. In addition to further recognition, beneficial

studies in the future would include a deeper delve into the performance metrics used for women in engineering fields during WWII, as this seems to be an area of research which is seriously lacking information.

Gender discrimination within the engineering workforce has negatively affected the women of World War II, creating disparities which persist today. Although challenging, the women of WWII paved the way to provide space for women in present day to enter into STEM fields. These women should be recognized for their contribution not only to the American war effort, but also for their advancement of diversity within the industry. In order to continue this advancement in present day, more aid and education should be given to women at an early academic stage in order to encourage and support their entrance into a STEM field.

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